

Redescription of *Protaphorura octopunctata* (Tullberg, 1876) and *Protaphorura quadriocellata* (Gisin, 1947) with description of two new related species from Siberia and Europe (Collembola: Onychiuridae)

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Redescription of *Protaphorura octopunctata* (Tullberg, 1876) and *Protaphorura quadriocellata* (Gisin, 1947) with description of two new related species from Siberia and Europe (Collembola: Onychiuridae). - *Protaphorura octopunctata* (Tullberg, 1876) and *Protaphorura quadriocellata* (Gisin, 1947) are redescribed based on type specimens and new materials. *Protaphorura flavorufula* (Martynova, 1976) is a junior synonym of *P. octopunctata*. *Protaphorura tolae* sp. n. and *Protaphorura saltuaria* sp. n. two new, closely related species from Yakutia and East Carpathians are described. An identification key to all Palearctic *Protaphorura* species with 4 and more pseudocelli at base of antenna is provided.

Keywords: Collembola - Onychiuridae - *Protaphorura* - taxonomy - Europe - Siberia.

INTRODUCTION

Protaphorura octopunctata (Tullberg, 1876) was described on the basis of one specimen collected in the delta of the Yenisei river near "Dudino" (at present Dudinka near Norilsk [69°24'N 86°08'E]). According to the information of Dr Kronestedt (Stockholm) there is no such specimen in the collections of the Swedish Museum of Natural History in Stockholm and in the Museum of Evolution, Uppsala University (Tullberg worked at Uppsala University). Only specimens collected during the "Yenissey-Expedition, 1876" have survived until today, labelled "Tschulkowa, *Lipura octopunctata*, Sibirien" (Chulkovo [62°45'N 88°25'E], situated on the left bank of the Yenisei river, about 45 km to the north of the Sukhaya Bakhta river mouth and Bakhta settlement) and determined by H. Schött.

A short Latin diagnosis and three drawings (Tullberg, 1876) point out the following characters of *P. octopunctata*:

- postantennal organ consists of 30 simple vesicles, arranged perpendicularly to the long axis of the organ;
- 4 pseudocelli at base of antenna;
- claw with denticle;
- small anal spines, a little arched;
- length – 2.5 mm.

During more than one hundred years this laconic description was a basis for many faunistic records from Europe, Asia and North America (Salmon, 1964; Yosii, 1977; Christiansen & Bellinger, 1989; Jordana *et al.*, 1997; Deharveng, 2005). Most of these records also contained a redescription of the species, but none of them was based on type or topotype material. Also Martynova's (1976) records were based on the materials from Chukotka and Magadan. At present, there is no convincing redescription of this species in the literature.

Thanks to the kindness of Dr Babenko (Moscow) we have received onychiurid material collected during ecological investigation of ecosystems of northern areas of Siberia. Some of these samples come from geographically and ecologically nearby areas (ca. 225 km eastern [69°08'N 91°49'E]) of the type locality of *P. octopunctata*. Within this material we have found two *Protaphorura* species with 4 pseudocelli at the base of antenna. Because of small size of reproductive adults (less than 1.5 mm in length) one could not be identified as *P. octopunctata* and represents a new species, belonging to another *Protaphorura* group of species. The second one we have compared with the specimens from Chulkovo (determined by Schött) and with the type material of *Protaphorura flavorifula* (Martynova, 1976) and we have ascertained that they are conspecific. The absence of other similar *Protaphorura* species in the closest neighbourhood of the delta of the Yenisei river is suggesting that *P. flavorifula* is a junior synonym of *P. octopunctata*.

Among the other Siberian materials (Yakutia) received from Dr Babenko we have found one species without pseudocelli at subcoxa, closely related to *P. octopunctata*.

Because of the presence of 4+4 pseudocelli at the antenna base *Protaphorura quadriocellata* (Gisin, 1947) is similar to *P. octopunctata* and initially the two species were confused. *Protaphorura quadriocellata* was first recorded from Switzerland by Gisin (1943) as "*Onychiurus octopunctatus* (Tullbg.) Stach (f. *daviesi* Bagn.)". In the next two publications the author gave it a subspecies rank (*Onychiurus armatus quadriocellatus*) (Gisin 1947) and subsequently species rank (*Onychiurus quadriocellatus*), and he listed the most important characters in a table (Gisin, 1952). The presence of 3+3 pseudocelli only on abdominal tergum IV (versus – 4+4 pseudocelli) is the character which makes it possible to distinguish *P. quadriocellata* from *P. octopunctata* and was used in Gisin's (1960) and Palissa's (1964) keys. At present *P. quadriocellata* is commonly accepted as a valid species and has been recorded from many European countries, viz. Austria, Great Britain, Denmark, Germany, Norway,

South Russia, Slovakia, Spain, Switzerland and Ukraine (Deharveng, 2005). Only one attempt at a redescription of this species is known, but it is based on specimens from Spain, far from the type locality (Jordana *et al.*, 1997).

Thanks to the kindness of Dr Lienhard (Geneva) we had a possibility to examine the holotype of *P. quadriocellata*. Its comparison with Ukrainian specimens from the East Carpathians (Kaprus', 1999) reveals that they represent different species.

In the light of the facts presented above we have decided to redescribe of *P. octopunctata* and *P. quadriocellata*. Besides, the present work contains descriptions of two new species.

The material is deposited in following institutions:

- MC Martynova's Collection in Moscow State Pedagogical University, Moscow;
MNHG Museum of the Natural History, Genève;
MNHU Museum of Natural History, Ukrainian National Academy of Sciences, L'viv;
SMNH Swedish Museum of Natural History, Stockholm;
ZIW Department of Biodiversity and Evolutionary Taxonomy, Zoological Institute, Wrocław University, Wrocław.

SPECIES DESCRIPTIONS

Protaphorura octopunctata (Tullberg, 1876)

Figs 1-5

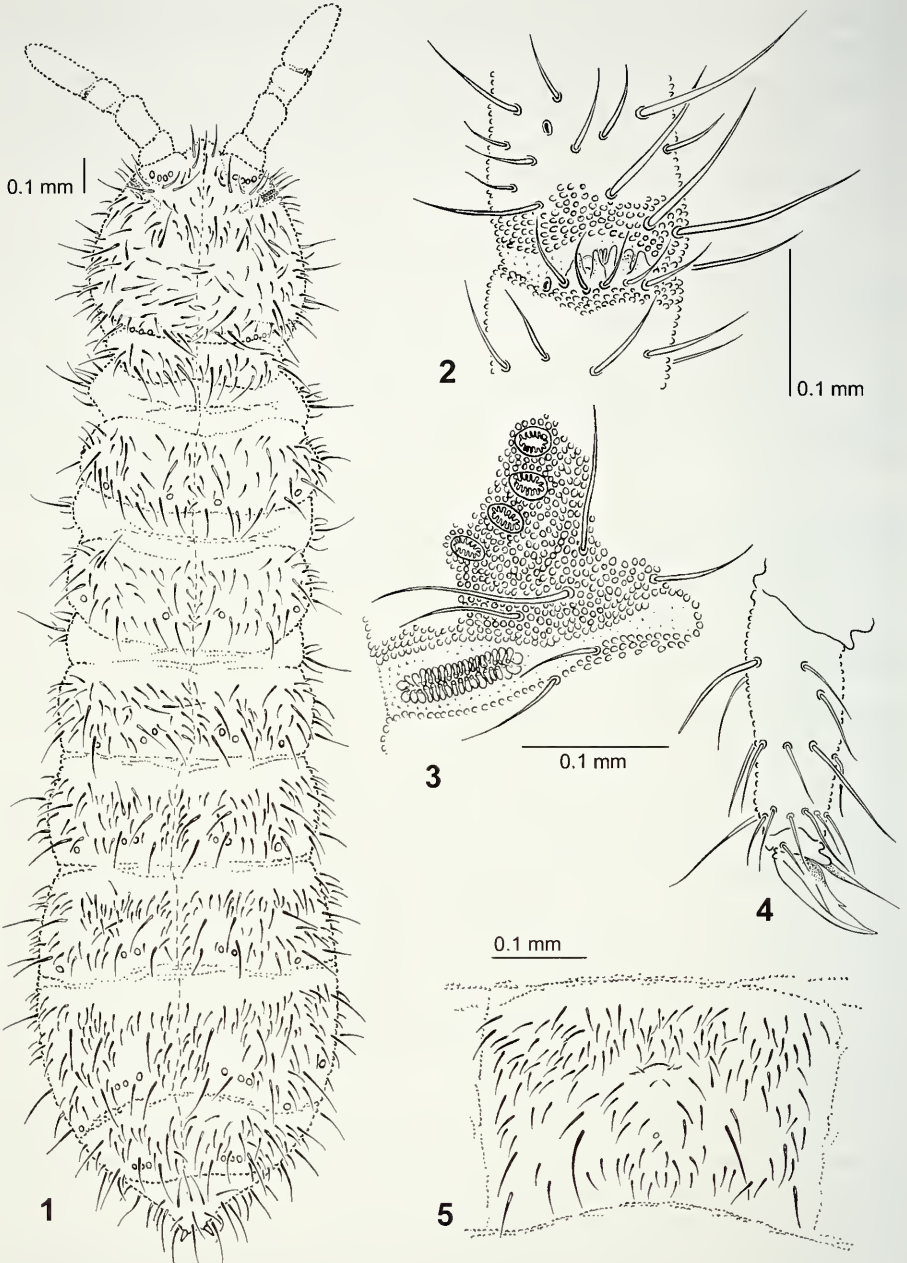
Bas. *Lipura octopunctata* Tullberg, 1876: 40.

Onychiurus (Protaphorura) flavorufulus Martynova, 1976 **syn. nov.**

MATERIAL: 2 unreplicative males, 6 females: Russia, Putorana Plateau, Dyngengda Mt., the *Alnetum* forest, near Sobachje Lake (Yt Kjuul') [69°08'N 91°49'E], litter, bush vegetation, 350 m alt., 27 VII 1997, leg. A. Babenko (MNHU, ZI). – 5 paratypes of *P. flavorufula* (2 unreplicative males, 3 females): Russia, Jakutia, harbor Ambartchik near Medvezhka river, 12 VIII 1972, leg. Shilov (MC). – 4 juvenile males, 2 juvenile females and 3 spp. fixed in alcohol: Russia, Krasnoyarskiy Krai, Chulkovo, the left bank of the Yenisei river (about 45 km north of the Sukhaya Bakhta river mouth and Bakhta settlement, 1876, leg. ? [62°45'N 88°25'E]) (originally labeled: *Lipura octopunctata* Tullb., Tchulkova, Jenisiejexp.76 determ. H. Schött) (SMNH). – 3 males, 5 females: Russia, Jakutia, delta of the Indigirka river, *Salix*, *Carex* and moss community on bog, 14-16 VII 1994, leg. A. Babenko. – 1 male, 1 female: Russia, Magadanskaya oblast, delta of the Kolyma river, Pokhotskaya jedoma, meadow, 18 VII 1994, leg. A. Babenko (ZIW).

DIAGNOSIS: Within the group of *Protaphorura* with four and more pseudocelli at base of antenna *P. octopunctata* is characterized by lack of pseudocelli on subcoxal and yellowish orange body color. It is closely related with described below *P. tolae* sp. n. (differences – see diagnosis of *P. tolae*).

REDESCRIPTION: Color in alcohol from yellowish to yellowish orange and reddish yellow. Length without antennae: males 2.5-3.1 mm, females 2.8-3.8 mm. Body shape cylindrical, with relatively small anal spines set on distinct papillae (Fig. 1). Antennae approximately as long as the head. Furca reduced to shallow cuticular pocket with 2+2 setulae – 1+1 setulae located on a cuticular fold, remaining



FIGS 1-5

Protaphorura octopunctata (Tullberg). (1) Habitus and dorsal chaetotaxy. (2) Antennal III sense organ. (3) Postantennal organ and anterior cephalic pseudocelli. (4) Tibiotarsal chaetotaxy and claw of legs III. (5) Chaetotaxy of abdominal sternum IV.

1+1 setulae located distinctly below of the fold (Fig. 5). Granulation is more or less uniform, distinct. Antennal area well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c.1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 5 low papillae, 2 sensory rods and 2 similarly sized sensory clubs: one is morel-like distinctly granulated, the other is sponge-like (Fig. 2). Sensory rods are relatively high, reached papillae length.

Postantennal sense organ consists of 30-40 simple vesicles (Fig. 3).

Pseudocellar formula dorsally: 4(5-6)3(4)/022/3335(4)3(4-5); ventrally: 1/000/00000, all subcoxal without pseudocelli. Formula of parapseudocelli ventrally: 1/000/111(0)101^m, all subcoxal with 1 parapseudocellus ventrally.

Dorsal chaetotaxy variable with a tendency to plurichaetosis, well differentiated into macro- and microsetae as in Fig. 1. Sensilla invisible. Head without d_0 , with p_2 at the same level as other p setae. Abdominal tergum V without or with seta p_0 , abdominal tergum VI usually with two, sometimes with three medial setae. Straight lines, passing through bases of short setae situated above anal spines, parallel. Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 13-19+13-19 setae and 2-3+2-3 setae at base.

Claws always with large teeth. Empodial appendage without basal lamella, appendage longer than inner edge of the claw. Tibiotarsi with 11 distal setae (Fig. 4). Male ventral organ is absent.

BIOLOGY: *P. octopunctatata* lives in humid habitats in mountains and lowlands. It has been collected in forest soil and litter and mosses, which covered the river bank and bog.

DISTRIBUTION: The species recorded from many countries, but probably most records are misidentifications. Univocal data come only from North and Middle Siberia.

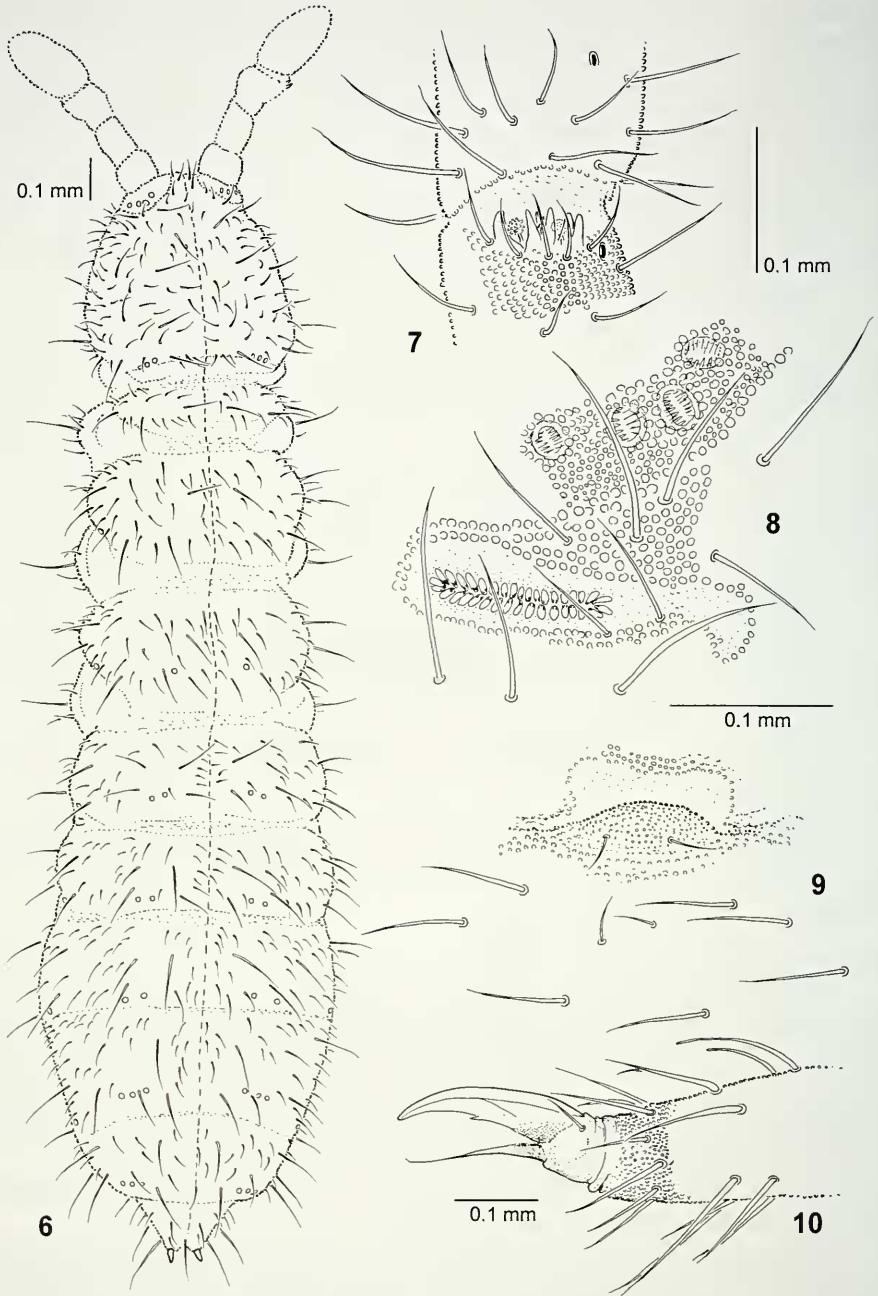
Protaphorura tolae sp. n.

Figs 6-10

TYPE MATERIAL: Holotype female and 14 paratypes (7 adult females, 7 unproductive males): Russia, Yakutia, Suntar Khayata Mt. Range, upper currents of Kyubyume river (63°13'N; 139°36'E, about 250 km to the east [along the only road] of Khangyga on Aldan River), 1430 m alt., southern slope, forest edge, droppings of mouse-hare or rock rabbit (= Ochotona), 7 VII 2002, leg. O. Makarova. The type material is preserved in following collections: ZIW – holotype and 5 paratypes (3 males and 2 females), MC – 2 females and 2 males, MNHG – 1 female and 1 male, MNHU – 3 males and 2 females).

ETYMOLOGY: The species is dedicated to our friend Dr Anatolyi Babenko (Moscow), for his material and valuable help.

DIAGNOSIS: Yellowish orange body color, relatively low papillae in antennal III sense organ, a shallow cuticular pocket as a remnant of furca and particularly the absence of pseudocelli on subcoxae are suggesting a close relationship of *P. tolae* sp. n. with *P. octopunctata*. The new species distinctly differs from *P. octopunctata* in pseudocellar formula and in more symmetrical chaetotaxy, without plurichaetosis.



FIGS 6-10

Protaphorura tolae sp. nov. (6) Habitus and dorsal chaetotaxy. (7) Antennal III sense organ. (8) Postantennal organ and anterior cephalic pseudocelli. (9) Remnant of furca. (10) Tibiotarsal chaetotaxy and claw of legs III.

DESCRIPTION: Color in alcohol from yellowish to yellowish orange and reddish yellow. Length without antennae: males 1.8-2.0 mm, females 2.5-2.75 mm. Body shape cylindrical, with relatively small anal spines set on distinct papillae (Fig. 6). Antennae approximately as long as the head. Furca reduced to shallow cuticular pocket with 2+2 setulae – 1+1 setulae located on a cuticular fold, remaining 1+1 setulae located distinctly below of the fold (Fig. 9). Granulation more or less uniform and distinct. Antennal area well marked.

Antennal segment IV with subapical organite. Microsensillum on antennal segment IV in latero-external position, c. 1/3 length from the base. Antennal segment III with microsensillum slightly below antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 5 low papillae, 2 sensory rods and 2 similarly sized sensory clubs: one is morel-like distinctly granulated, the other sponge-like. (Fig. 7). Sensory rods relatively high, reached papillae length.

Postantennal sense organ consists of 36-40 simple vesicles (Fig. 8).

Pseudocellar formula dorsally: 43/012/332-343 (on thoracic tergum IV lack of anterolateral pseudocelli); ventrally: 1/000/00000, all subcoxa1 without pseudocelli. Formula of parapseudocelli ventrally: 1/000/100000, all subcoxa1 with 1 parapseudocellus ventrally.

Dorsal chaetotaxy rather regular, well differentiated into macro- and microsetae as in Fig. 6. Sensilla invisible. Abdominal tergum V with seta p_0 , abdominal tergum VI with one medial setae. Straight lines, passing through bases of short setae which are situated above anal spines are parallel. There are 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 10-11+10-11 setae and 2+2 setae between legs on pro-, meso- and metathorax at the base.

Claws always with large teeth. Empodial appendage without basal lamella, appendage longer than inner edge of the claw (Fig. 10). Tibiotarsi with 11 distal setae. Male ventral organ is absent.

***Protaphorura quadriocellata* (Gisin, 1947)**

Figs 11-15

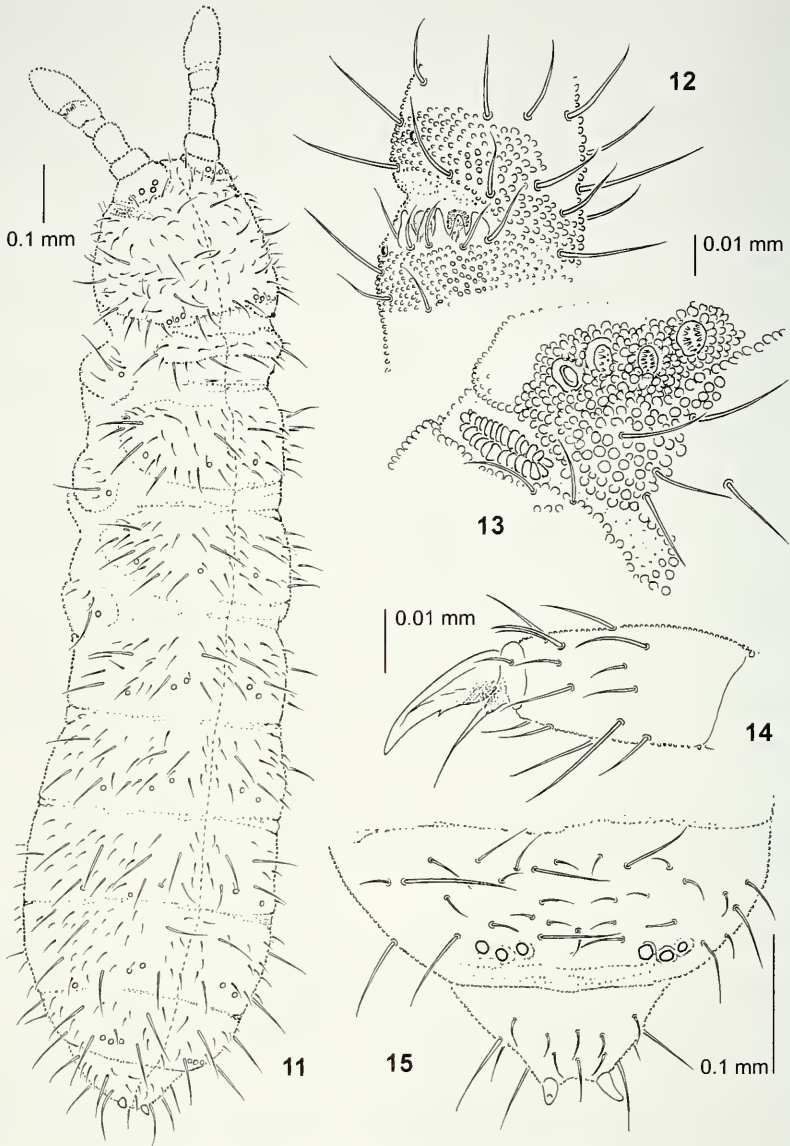
Bas. *Onychiurus armatus quadriocellatus* Gisin, 1947:

TYPE MATERIAL: Holotype – unreproductive/reproductive, moulting male, (G930) Switzerland, Langenthal (BE), *Sphagnum* in *Fagus* forest, 24 VIII 1941 (MNHG).

OTHER MATERIAL EXAMINED: 1 male, 2 females, 7 juveniles Germany, Hessen, Hochaunus near Frankfurt am Main, litter of cultivated, mixed forest; 21 VII 2001. leg. A. Smolis (ZIW). – 5 males, 4 females, Germany, Augsburg, near Munich, litter +soil, *Fagus-Abies* forest; 15 IV 2003. leg. T. Zieche (MNHU).

DIAGNOSIS: *P. quadriocellata* belongs to the group of *Protaphorura* species with 4+4 pseudocelli at base of antenna, 2+2 pseudocelli on thoracic terga II and III and without anterolateral pseudocelli on abdominal tergum IV. It is closely related with described below *P. saltuaria* sp. n. (differences – see diagnosis of *P. saltuaria*).

REDESCRIPTION: Color white. Length without antennae: males 1.8-2.0 mm, females 2.1-2.4 mm. Body shape is cylindrical, with relatively small anal spines set on distinct papillae (Fig. 11). Antennae approximately as long as the head. Furca



FIGS 11-15

Protaphorura quadriocellata (Gisin). (11) Habitus and dorsal chaetotaxy. (12) Antennal III sense organ. (13) Postantennal organ and anterior cephalic pseudocelli. (14) Tibiotarsal chaetotaxy and claw of legs III. (15) Chaetotaxy of abdominal tergum V and VI (11 specimen from Germany; 12-15, holotype).

reduced to cuticular pocket with 2+2 setulae. Granulation more or less uniform, distinct. Antennal area well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, usually at 1/3 height of antennal IV, somewhat above the second row of setae. Antennal segment III with microsensillum slightly below antennal III sense organ (Fig. 12). Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ built of 5 guard setae, 5 low papillae, 2 sensory rods and 2 similarly sized sensory clubs: one is morel-like finely granulated, the other is sponge-like (Fig. 12).

Postantennal sense organ consists of 28-36 simple vesicles (Fig. 13).

Pseudocellar formula dorsally: 43(4)/022/33333; ventrally: 1/000/00000, each subcoxal with 1 pseudocellus. Formula of parapseudocelli ventrally: 1/000/111101^m, all subcoxal with 1 parapseudocellus ventrally.

Dorsal chaetotaxy symmetrical, well differentiated into macro- and microsetae as in fig. 11. Sensilla invisible. Head without d_0 , with p_2 shifted forward in relation to other p setae. Abdominal tergum V with seta p_0 , abdominal tergum VI usually with two medial setae (Figs 11, 15). Straight lines, passing through bases of short setae situated above anal spines, parallel. Between legs on pro-, meso- and metathorax 1+1, 2+2 and 2+2 setae respectively. Tubus ventralis with ca. 13-19+13-19 setae and 2+2 setae at base.

Claws with large teeth (claw III of holotype is without teeth). Empodial appendage without basal lamella, appendage longer than inner edge of the claw. Tibiotarsi with 11 distal setae (Fig. 14). Male ventral organ absent.

Protaphorura saltuaria sp. nov.

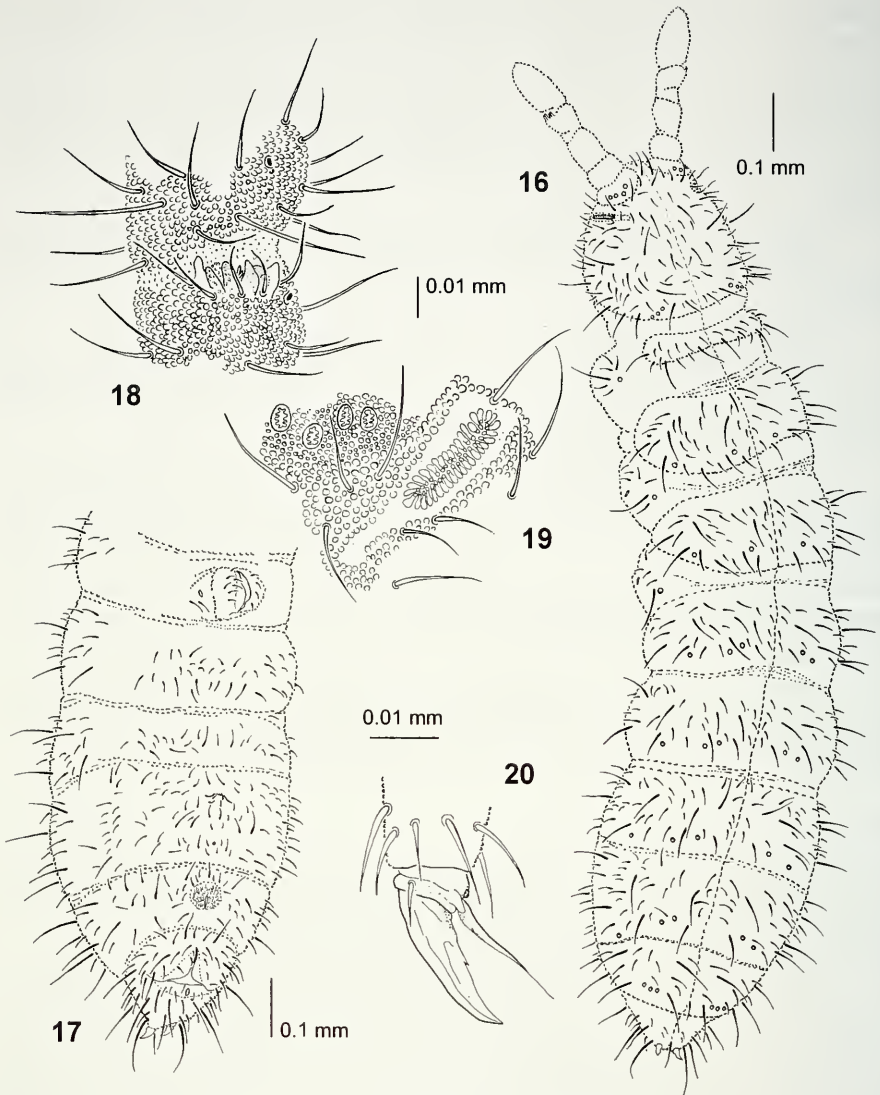
Figs 16-20

TYPE MATERIAL: Holotype – 1 male and 14 paratypes (4 males, 10 females) Ukraine, East Carpathians, Chornoghora Mt., Vorochta, soil and litter in Piceetum forest, 1450 m alt., 24 VIII 1993, leg. I. Kaprus'. The type material is preserved in following collections: MNHU – holotype and 11 paratypes (4 males and 7 females), MNHG – 3 females.

OTHER MATERIAL EXAMINED: 3 males, 4 females, Ukraine, East Carpathians, Skoliv's'ki Beskydy Mt., Kamianka, soil and litter in Fagaetum forest, 900 m alt., 25 X 1989, leg. I. Kaprus' (MNHU). – 1 male, Ukraine, East Carpathians, Chyvchyny Mt., Burkut, soil and litter of Piceetum forest, 1100 m alt., 4 VIII 1991, leg. I. Kaprus' (MNHU). – 2 males, Ukraine, East Carpathians, Chorna Mt., Vynohradove, soil and litter in Fagaetum forest, 450 m alt., 5 IV 1989, leg. I. Kaprus' (MNHU). – 1 female, Poland, East Carpathians, Bieszczady Mt., Muczne, soil and litter in Abieto-Fagaetum forest, 650 m alt., 1 X 1996, leg. I. Kaprus' (MNHU). – 1 female, Poland, East Carpathians, Bieszczady Mt., Sękowski, soil and litter in Abieto-Fagaetum forest, 550 m alt., 1 X 1996, leg. I. Kaprus' (ZIW).

ETYMOLOGY: The species name is derived from the Latin word "saltus" – mountain forest.

DIAGNOSIS: Because of the presence of pseudocelli on all subcoxa and the same dorsal pseudocellar formula *P. saltuaria* sp. n. is closely related with *P. quadriocellata*. This new species distinctly differs from *P. quadriocellata* in the lack of parapseudocelli on abdominal sterna II-IV, in the presence of only one medial seta in



FIGS 16-20

Protaphorura saltuaria sp. nov. (16) Habitus and dorsal chaetotaxy. (17) Chaetotaxy of abdominal sterna I-VI. (18) Antennal III sense organ. (19) Postantennal organ and anterior cephalic pseudocelli. (20) Distal part of leg III.

abdominal tergum VI and in location of p_2 seta on the head. *P. quadriocellata* has parapseudocelli on all abdominal sterna, p_2 seta in anterior position and usually has two medial setae on abdominal tergum VI.

DESCRIPTION: Color in alcohol yellowish white. Length without antennae: males 1.8-2.0 mm, females 1.7-2.2 mm. Body shape cylindrical, with strong anal

spines set on distinct papillae (Fig. 16). Antennae approximately as long as the head. Furca reduced to cuticular pocket with 2+2 setulae. Granulation more or less uniform and distinct. Area antennalis well marked.

Antennal segment IV with a subapical organite. Microsensillum on antennal segment IV in latero-external position, c. 1/3 length from the base. Antennal segment III with microsensillum slightly below of antennal III sense organ. Thoracic terga II and III with microsensilla laterally.

Antennal III sense organ consists of 5 guard setae, 2 sensory rods, 2 straight and granulated sensory clubs and 5 papillae (Fig. 18).

Postantennal sense organ consists of 35-42 simple vesicles (Fig. 19).

Pseudocellar formula dorsally: 4(3)3/022/33333; ventrally: 1/000/00000, all subcoxal with pseudocellus. Formula of parapseudocelli ventrally: 1/000/100001^m, all subcoxal with 1 parapseudocellus. Position of pseudocelli and parapseudocelli is presented in Figs 16 and 17.

Dorsal chaetotaxy, usually symmetrical, well differentiated into macrochaetae and microchaetae as in fig. 16. Sensilla weakly marked. Head without seta d_0 , with p_2 at the same level as other p-setae. Abdominal tergum V with seta p_0 , abdominal tergum VI with one medial seta. Straight lines, passing through bases of short setae with are situated above anal spines, parallel. There are 1+1, 2+2 and 2+2 setae between legs on pro-, meso- and metathorax, respectively. Tubus ventralis with ca. 9+9 setae and 2+2 setae at the base. Ventral abdominal chaetotaxy as in Fig. 17.

Claws are with small teeth. Empodial appendage without basal lamella, slightly longer than inner edge of the claw. Tibiotarsi with 11 distal setae (Fig. 20). Male ventral organ absent.

BIOLOGY: *P. saltuaria* lives in humid litter and soil of beech and spruce forests of the Eastern Carpathians.

A KEY TO THE PALEARCTIC *PROTAPHORURA* SPECIES WITH 4 AND MORE PSEUDOCELLI AT BASE OF ANTENNA

- 1 Subcoxae1 of I, II and III pair of legs without pseudocelli 2
- Subcoxae1 of I, II, and III pair of legs with 1, 0, 0 pseudocelli respectively . . 3
- Subcoxae1 of I, II, and III pair of legs with 1, 1, 1 pseudocelli respectively . . 4
- 2 Pseudocellar formula dorsally: 4-63-4/022/3334-53-5 dorsomedial pseudocelli on thoracic tergum I and anterolateral pseudocelli on abdominal tergum IV present
 *P. octopunctata* (Tullberg, 1876) North Asiatic part of Russia
- Pseudocellar formula dorsally: 43/012/332-343, on thoracic tergum I lack of dorsomedial pseudocelli, on thoracic tergum IV lack of anterolateral pseudocelli *P. tolai* sp. n. Russia: Jacutia
- 3 Pseudocellar formula dorsally: 43/022/33342, claw with strong denticle
 *P. mongolica* (Martynova, 1970) Mongolia
- Pseudocellar formula dorsally: 43/022/33343, claw without or rarely with very small denticle *P. serbica* (Loksa & Bogojevic, 1976)

- Central and South East Europe, Caucasus Mts., Crimea Mts., Kazakhstan, Tadzhykistan, South Siberia
- 4 Thoracic terga II-III with 3+3 and 3+3 pseudocelli respectively
 *P. pseudocellata* (Naglitsch, 1962)
 Great Britain, Czech Republic, Germany, Poland, Ukraine
- Thoracic terga II-III with 2+2 and 3+3 pseudocelli respectively 5
- Thoracic terga II-III with 2+2 and 2+2 pseudocelli respectively 6
- 5 Pseudocellar formula dorsally: 54/023/454-75-65
 *P. decempunctata* (Kos, 1939) Slovenia
- Pseudocellar formula dorsally: 44/023/34353
 *P. caledonica* (Bagnall, 1937) Great Britain
- Pseudocellar formula dorsally: 43/023/44453 *P. macfadyeni* (Gisin, 1953)
 Denmark, Finland, Germany, Iceland, Norway, Jan Mayen & Svalbard, Sweden
- 6 Abdominal tergum IV without anterolateral pseudocelli 7
- Abdominal tergum IV with anterolateral pseudocelli 9
- 7 Head with 4+4 posterior pseudocelli; pseudocellar formula dorsally:
 44/022/33333 *P. suboctopuntata* (Khanislamova, 1986) Russia: Bashkiria
- Head with 3+3 posterior pseudocelli; pseudocellar formula dorsally:
 43/022/33333 8
- 8 Abdominal sterna II-IV with 1+1 parapseudocelli
 *P. quadriocellata* (Gisin, 1947)
 Austria, Great Britain, Denmark, Germany, Norway, Slovakia, South Russia,
 Spain, Switzerland
- Abdominal sterna II-IV without parapseudocelli
 *P. saltuaria* sp. n. Ukraine, Poland
- 9 Sensory rods of antennal III sense organ higher than accompanying
 papillae, the first one is located at external surface of base of first
 internal papilla, the second one located between of third and fourth
 papillae; pseudocellar formula dorsally: 43/022/33353(4)
 *P. nutak* (Yosii, 1972) Japan, Far East of Russia
- Sensory rods of antennal III sense organ shorter than accompanying
 papillae and arranged typical, closely together, behind of papillae in the
 middle part of the organ 10
- 10 Males with ventral organ 11
- Males without ventral organ 12
- 11 Males ventral organ located between abdominal sterna II and III;
 pseudocellar formula dorsally: 43/022/3334-33
 *P. janstachi* (Yosii, 1972) Russia: Caucasus
- Males ventral organ located between abdominal sterna III and IV;
 pseudocellar formula dorsally: 44-3/022/3335(4,6)3
 *P. eichhorni* (Gisin, 1954) Luxemburg
- 12 Pseudocellar formula dorsally: 43/022/46655
 *P. asensitiva* (Stach, 1954) Slovenia
- Pseudocellar formula dorsally: 43/022/33353
 *P. valsainensis* (Acón, 1981) Spain

ACKNOWLEDGEMENTS

We are greatly indebted to Dr Anatolyi Babenko (Severtsov Institute of Ecology and Evolution RAN, Moscow) for his material, information and valuable help in finding the places of collection of onychiurids on the map of Russia. We wish to express our sincere thanks to Dr Charles Lienhard (Museum of the Natural History, Genève) and Dr Torbjörn Kronestedt (Swedish Museum of Natural History, Stockholm) for the loan of type and historic materials. The study was sponsored by the Wrocław University – grant n^o: 7-13-1201; 1018/S/IZ/2005.

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